TRANSLATION OF PCT/EP2003/014388 10/549245
JC17 Rec'd PCT/PTO 12 SEP 2005

INSERTION PART FOR INSERTING INTO A GAS OR LIQUID LINE

The invention relates to an insertion part, which is embodied as a back-flow preventer and which can be inserted into a gas or liquid line, with the insertion part comprising a housing, with at least one displaceable closing body arranged inside the housing, which in a closed position seals the flow opening of a feeder line.

The present invention also relates to an insertion part, which is embodied as a flow regulator and which can be inserted into a gas or liquid line, with the insertion part comprising a housing and at least one throttle body or control body being arranged inside of the housing, limiting a control gap between itself and an adjacent housing wall that changes depending on pressure.

Sanitary insertion parts of the type mentioned at the outset are known, which are inserted into the water line, in order to even the amount of water flowing per time unit and/or in order to prevent a temporary back flow of the water.

For instance, flow regulators have been produced, which are provided with a tapering or cone-shaped housing core inside the housing. The housing core is surrounded by an annular throttle body or control body made from an elastic material, which limits a control gap between itself and the housing core, that can be changed depending on pressure. When producing the previously known flow regulators, the required throttle body or control bodies are subject to the elastic features of the rubber material, which can lead to different control characteristics of individual insertion parts.

Therefore, the object of the invention is to provide a versatile insertion part, which is characterized in a simple production and preferably in a constant and secure function as well.

The object is attained according to the invention in the insertion part embodied as a back-flow preventer of the type mentioned at the outset such that the insertion part is provided with an annular lip-shaped part, which is held inside the housing with its annular body and which, in the area of at least one flow opening, is provided with a sealing lip, that can be displaced, serving as a closing body and contacting, in the closed position, the opposing housing surface with a lip-end region in a sealing fashion.

The insertion part according to the invention, which can be inserted into a gas or liquid line as a back-flow preventer, is provided with an annular lip shaped part held inside the housing with its annular body. This lip shaped part has at least one sealing lip, that can be displaced by the liquid, serving as a sealing body, which is displaced such by the back-flow of the fluid in a direction of the opposing housing surface so that the sealing lip, in its closing position, contacts the housing surface with its lip end-region in a sealing fashion. When the housing is embodied in one piece, the insertion part according to the invention can be easily produced from essentially two pieces, namely the housing and the lip shaped piece. This small number of components is beneficial for the highly secure functionality of the insertion part according to the invention.

Here, one preferred embodiment of the invention provides that a housing core is arranged inside the housing, which limits a flow opening between itself and an interior circumference of the housing, and that the lip shaped part is held to the interior circumference of the housing with its annular body and, in the closing position, the free lip-end region of its sealing lip contacts the housing core in a sealing fashion.

The solution according to the invention particularly provides that the insertion part, embodied as a flow regulator is provided with an annular lip shaped part, which is held inside the housing with its annular body and which is provided with at least one control lip, embodied as a control body and aligned with its free lip end extending in the direction of the adjacent housing wall.

The insertion part that can be inserted into a gas or liquid line as a flow regulator also comprises a lip shaped part held inside the housing. This lip shaped part is provided with at least one control lip embodied as a throttle body or control body, with a free lip end thereof extending in the direction of the adjacent housing wall. This control lip can be displaced depending of the pressure of the fluid such that the control gap provided between the control lip and the adjacent housing wall is modified depending on the pressure. Due to the fact that the insertion part, essentially made from two components, which can be produced with little expense, comprises a control lip and that the reaction behavior of the control body is less dependent on the elastic features of the material composition used but rather on the form and the dimensions of the control lip, this insertion part is particularly characterized in a constant control function as well.

One preferred embodiment according to the invention provides for the lip shaped part to be held with its annular body at an interior circumference of the housing and for the free lip end of its control lip to be aligned in a direction of the adjacent housing wall of a housing core.

A further development according to the invention, worth protecting in itself, which combines in a single component the function of a flow regulator and a back-flow preventer, provides that the lip shaped part has at least one upstream regulating or control lip and at least one downstream sealing lip.

In order to achieve a sensitive control with the flow regulator according to the invention, largely independent of the material, it is advantageous for the control lip to face with its free lip end region in a direction opposite the flow direction of the fluid, and limiting the upstream open annular space between itself and the interior circumference of the housing. In this blind-hole type annular space that opens upstream, the inflowing fluid contacts the control lip such that it is pressed against the housing core depending on the pressure and changes the control gap limiting and leveling the amount of the flow.

In order to allow the targeted amount of fluid to flow through the insertion part unhindered even under high pressure, it is beneficial to provide a regulating profiling at the housing wall adjacent to the free lip end of the control lip, with the regulating profiling preferably being formed by moldings aligned in the direction of the flow. These moldings may also be provided at the housing core in the area of the control lip, for example. Due to the fact that the control lip is not pressed in a direction of the adjacent housing wall until a defined pressure value has been reached, the control lip reacts with a distinctly noticeable peak at this pressure value, which can be utilized as a control impulse for subsequent devices downstream.

Here, a sensitive reaction of the insertion part serving at least as a flow regulator is promoted if the molding, preferably evenly distributed over the circumference of the wall of the adjacent housing wall, is arc-shaped or similarly rounded.

In contrast thereto, the sealing lip of the insertion part serving at least as a back-flow preventer can be aligned in the radial direction and, in the closed position, cooperate with an annular flange at the housing core. However, an embodiment is preferred, in which the sealing lip is arranged with its free lip end region extending in the direction of the flow. In the event of an undesired back-flow, such a sealing lip, aligned in the flow direction, can also contact a cylindrical or cone-shaped and/or tapered housing core in a sealing manner.

Here, it is advantageous for the housing wall adjacent to the free lip end to have a wall section free from grooves or moldings in the area impinged by the sealing lip.

While the housing is preferably made from a suitable dimensionally stable metal or, in particular, plastic material, if necessary, one preferred embodiment of the invention provides for the lip shaped part to be made from an elastic rubber or plastic material.

Although the reaction pressure and the reaction behavior of the control and/or sealing lips can be solely influenced and determined by the shore-hardness of the rubber-elastic

material, for example, an embodiment is preferred, though, in which the reaction pressure and the reaction behavior of the control lip and/or the sealing lip is predetermined by the length, the thickness, or a similar design and dimension of the lip(s) and/or by the material characteristics of the lip shaped part.

For example, the lip shaped part can be inserted and held in a groove, which is provided at the interior circumference of the housing made in one piece, if necessary. However, an embodiment is preferred, in which the housing of the insertion part is provided in at least two parts, and the annular lip shaped part is held with its annular body between two adjacent housing parts.

Here, it can be beneficial for the annular body of the lip shaped part to be embodied as a housing part seal for the adjacent housing parts.

In order to be able to perhaps optimize the functions of the insertion part according to the invention with regard to control flow and preventing back-flow, it can be advantageous for the control body of the lip shaped part at both sides to comprise at least one control and/or sealing lip, and for the control and/or sealing lip to be arranged in an area of an allocated flow opening and/or in the area of a control gap.

Here, a further development according to the invention, for which independent protection is warranted, provides that one control lip and one sealing lip are provided at both sides of the control body of a preferably generally star shaped or x-shaped lip shaped part. The lips are located on the opposite sides of the control body and are each allocated to a control gap with a downstream flow opening. Such a star shaped or x-shaped lip shaped part can for example be glued, welded or mounted in a similar manner to a downstream face of an annular housing wall, which is arranged approximately in the center inside the housing. This component can essentially be made from two components, namely the housing and the lip shaped part connected thereto.

In order to provide the lip shaped part in the insertion part with a solid and safe fastening, it is advantageous for the annular body of the lip shaped part to be fastened in a housing chamber between the upstream housing part and the downstream housing part. Here, a preferred embodiment of the invention provides for the housing chamber to be closed except for an annular gap and that the annular gap is penetrated by a connecting part of the lip shaped part, connecting its annular body with the control and/or sealing lips.

The small production expense for the insertion part according to the invention is reduced even further if the housing parts adjacent to the lip shaped part can be snapped together. For the same reason it is useful if the housing core, preferably cone-shaped or tapering in the flow direction, is connected to an upstream housing part via an at least radially extending connection bar in one piece.

Additional embodiments of the invention are described in the other subclaims. In the following, the invention and its essential features is explained in greater detail using the drawings.

The drawings show:

Fig. 1 an insertion part, in a longitudinal cross-section, embodied as a flow regulator, with its control lip cooperating with a cone shaped or tapered central housing core also located inside the housing,

Fig. 2 an insertion part, also shown in a longitudinal cross-section similar to the embodiment of Fig. 1, which is embodied both as a flow regulator as well as a back-flow preventer and with its lip shaped part additionally comprising a downstream sealing lip,

Fig. 3 a flow regulator comparable to the one in Fig. 1 shown during increased pressure conditions in longitudinal cross-sections (cf. Figs. 3a, 3c, 3e) and cross-sections (cf. Figs. 3b, 3d, 3f), and

Fig. 4 various embodiments of the insertion part, adapted to the desired reaction behavior, and the performance diagrams allocated to the illustrated embodiments.

In the Figs. 1 and 2 insertion parts 1, 100 are shown, which can be used at least as flow regulators in a gas or liquid line. The insertion parts 1, 100 are provided with a housing 2, with an annular lip shaped part 3 being held against an interior housing circumference.

As discernible from Figs. 1 and 2, the housing 2 is provided in two parts, an upstream part and a downstream part 4, 5. The lip shaped part 3 is fastened with its annular body 6 in a housing chamber 7 between the upstream and the downstream housing parts 4, 5. This housing chamber 7 is formed in a closed fashion except for an annular gap. The annular gap is penetrated by a connecting part 8 of the lip shaped part 3, which connects the annular body 6 with an annular control lip 9.

The control lip 9 is embodied as a throttle body or control body, limiting a control gap between the control lip 9 and a central housing core 10, with the gap changing depending on pressure.

As shown in Figs. 1 and 2, the control lip 9 is aligned with its free lip end region in an opposite direction to the flow direction Pfl of the fluid, and delimits a blind hole-type annular space 11, that is open towards the upstream side. After reaching the predetermined pressure of the fluid flowing in through the line and thus also through the insertion part 1, 100, the control lip 9 is pressed, depending on pressure, in the direction of the housing core 10 such that the control gap narrows. By this pressure-dependent movement of the control lip 9 and the narrowing of the control gap resulting therefrom, the amount of fluid flowing per time unit remains generally constant even in strong pressure variations, with the flow amount remaining within a predetermined tolerance range.

The housing core 10 is provided tapered or cone-shaped and narrows evenly in the flow direction Pf1. The housing core 10, connected in one piece with the housing part 4 via a bar 12 aligned radially with respect to the flow direction, is provided at its exterior circumference, as discernible in the cross-sections shown in Figs. 3b, 3d, and 3f, with moldings 13, shaped as an ellipsoid, polygonal, or arc-shaped, as shown, which form circumferentially open flow channels aligned in the flow direction. These moldings 13 are evenly distributed over the circumference of the housing core 10.

The insertion part 100 shown in Fig. 2 is additionally embodied as a back-flow preventer, as well. At the connection part 8 of the lip shaped part it is also provided with a sealing lip 14 arranged downstream of the control lip 9, that can be displaced by the fluid and is aligned with a free lip end region thereof extending in the flow direction Pf1. This sealing lip 14 is provided as sealing body, which seals in the closed position a flow opening limited between the housing core 10 and the interior circumference of the housing. In an undesired back-flow of the fluid opposite to the flow direction Pf1, the sealing lip 14 is pressed in the direction of the housing core 10 such that it contacts with the free lip end region thereof the opposing housing surface in a sealing manner. For this purpose, the housing core 10 has a core region free from grooves or moldings that is impinged by the sealing lip 14.

In Figs. 4b, 4d, and 4f the amount of flow per time unit depending on the pressure of the fluid are shown for different embodiments of the lip shaped part. The corresponding insertion parts 1, embodied as flow regulators, with their various lip shaped parts 3 being shown in Figs. 3a, 3c, and 3e in a cross-section. As discernible from a comparison of Figs. 4a through 4f, the reaction pressure and the reaction response of the lips 9, 14, and particularly of the control lip 9, can be predetermined by the length, the thickness, or similar design features and dimensions of the lip 9, 14 and also by the shore-hardness and similar material characteristics of the lip shaped part 3.

A particular advantage of the flow regulator 1, 100 shown here is that its reaction behavior is less dependent on the material characteristics of the rubber-elastic throttle body or control body 9 but rather on its design and dimensions.

As shown in Figs. 3a, and 3b, the control lip 9 hardly changes under light pressure. In Figs. 3c and 3d it is discernible that the control lip 9 quickly reacts to slightly rising water pressure and is pressed in the direction towards the housing core 10. This pressure-dependant motion of the control lip 9 is discernible as a distinct peak in the curve progression in Figs. 4b, 4d, and 4f. This peak, which is more or less discernible depending on the design of the control lip 9, can be used as a controlling impulse, in order to start a flow heater, for example.

In Figs. 3e and 3f it is discernible that the control lip 9 is also pressed into the moldings 13 in the housing core during increasing water pressure, with a maximum flow amount per time unit not being exceeded.

The control lip 9 of the insertion part 1 shown in Fig. 4a is predetermined for a low pressure range between 0.2 and 3.0 bar and amounts of liquids between 1 to 8 l/min. For this purpose, the free lip end region is designed thin and arranged in proximity to the housing core 10 even in the resting position.

The control lip 9 of the insertion part 1 shown in Figs. 4c and 4d is designed for high pressure values from 1 to 10 bar and for flow amounts of 1 to 2 l/min. For this purpose, the free lip end region is designed relatively thick and positioned farther apart from the housing core. Therefore, a higher pressure is required for pressing this control lip 9 into the moldings 13 of the housing core 10.

In Fig. 4e an insertion part 1 is shown, which has a very thin and comparatively long control lip 9, reaching with its free lip end region to the proximity of the housing core 10. The insertion part 1 according to Fig. 4e is designed for fluids with low viscosity and/or fluids with little density, such as for example air or other gases, and for low pressure and

high flow amounts per time unit of approximately 80 l/min. This insertion part can also be used for such applications, in which conventional flow regulators with an O-ring shaped throttle body or control body cannot be used. Here, in contrast to conventional flow regulators, the reaction pressure and the reaction behavior can be varied in both areas by an appropriate selection of geometry and material of the lip shaped part 3 and its control lip 9. The reaction pressure of such insertion parts can be designed such, using appropriate geometrical designs by its control lip 9, that the reaction pressure is as low as 0.2 bar, for example.

The insertion parts 1, 100 shown here can be used for multiple purposes and they are characterized by a simple production and a consistent and secure function.